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Technical Report for Idaho Department of Fish and Game Permit No. F-10-99

Boise River Bull Trout Population Monitoring and Mitigation Activities

Annual Report for 2005

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Annual Report 2005

U.S. Bureau of Reclamation, Snake River Area Office West

230 Collins Road, Boise Idaho 83702

by

Tammy Salow, Fishery Biologist
U.S. Bureau of Reclamation

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BOISE RIVER BULL TROUT POPULATION MONITORING AND MITIGATION ACTIVITIES 2005

Introduction

Since the listing of the Columbia River and Klamath River distinct population segment of bull trout (*Salvelinus confluentus*) as threatened under the Endangered Species Act in 1998, serious consideration has been given to range-wide population size and recovery efforts. Section 7 of the Endangered Species Act requires that any actions that may be implemented by the federal government entity that could affect federally listed species must be consulted upon through the federal regulatory agencies: the U.S. Fish and Wildlife Service (FWS) or the National Marine Fisheries Service. The U.S. Bureau of Reclamation consulted upon its water operations in the Upper Snake River in 2004 (Reclamation 2004). Reclamation was issued a Biological Opinion from the FWS in 2005 with numerous mandates, including terms and conditions that address entrainment of bull trout at facilities where bull trout occur. Arrowrock Dam was identified as one project with significant rates of entrainment that would require reduction and mitigation until an appropriate level of entrainment was reached (FWS 2005). This report describes the results of Reclamation's mitigation work and its cooperative population monitoring work with the U.S. Forest Service, Boise National Forest.

The Boise River basin is a highly regulated river system, with three reservoirs and numerous irrigation diversions. These water projects were constructed primarily for the purpose of providing irrigation water, hydroelectricity, and flood control, but they are also important recreation areas and provide fish and wildlife habitat. The subpopulations of bull trout in the Boise River basin form one of the southern-most distributions in the Columbia River basin (Rieman et al. 1997). Although the Boise River basin is divided into segments by several dams, the sub-basins upstream from Arrowrock and Anderson Ranch reservoirs provide substantial habitat for bull trout; their presence and migration have been recorded throughout the watersheds (Rieman and McIntyre 1995, IDFG unpublished data 1998, Flatter 2000, Salow 2001).

Arrowrock Dam was constructed in 1915 by the U. S. Bureau of Reclamation (Reclamation) as part of the Boise Projects. The valve outlet works of the facility have exceeded the age for which they were designed and were replaced in 2003 (Reclamation 2001). The valve replacement work was initiated in 2001 and required a near complete evacuation of the reservoir volume from September 2003 through February 2004 to complete construction. Reclamation has completed a Final Environmental Impact Statement and Biological Assessment for the impacts of the valve replacement project to comply with the National Environmental Policy Act and the Endangered Species Act respectively (Reclamation 2001).

The purpose of this report is to summarize the annual population monitoring and mitigation activities which occurred under Idaho Department of Fish and Game Scientific Collection Permit No. F-10-99 in the Boise River Basin.

Study Area

The Boise River basin is located in southwestern Idaho and is a major tributary to the Snake River (Figure 1). Three dams are constructed on the upper Boise River system: Arrowrock, Anderson Ranch, and Lucky Peak dams. Lucky Peak Dam, a U.S. Army Corps of Engineers project, is located at the lowest elevation in the Boise River at river kilometer (rkm) 103 with a full pool elevation of 931 meters above sea level. Arrowrock Dam, Reclamation project is 19 rkm upstream from Lucky Peak Dam on the mainstem Boise River. Arrowrock Dam has a full pool elevation of 980 meters above sea level. Anderson Ranch Dam, also a Reclamation project, is the most upstream of the three projects, located at rkm 81 of the South Fork of the Boise River with a full pool elevation of 1,272 meters above sea level. These reservoirs are operated collectively as one system for irrigation, flood control, and recreation.

The Boise River basin upstream from Arrowrock Dam covers 5,700 km² (2,200 mile^2) of the granitic rock dominated landscape with elevations ranging from 931 m (3057 ft.) to 3,231 m (10,600 ft.) above sea level. The upper Boise River includes three sub-basins: the North, Middle, and South Forks. The Boise River system is fed primarily by snowmelt run-off with highest flows occurring in April-May and lowest in September-October. Flows range from 4.25 m³/s (150 ft^3/s) to over 339.8 m³/s (12,000 ft^3/s) in the mainstem Boise River below the North and Middle Fork confluence. Land uses in the Boise River watershed include grazing, recreation, and both commercial and individual timber harvest. The majority of the Boise River basin lies within Forest Service or Wilderness area boundaries.

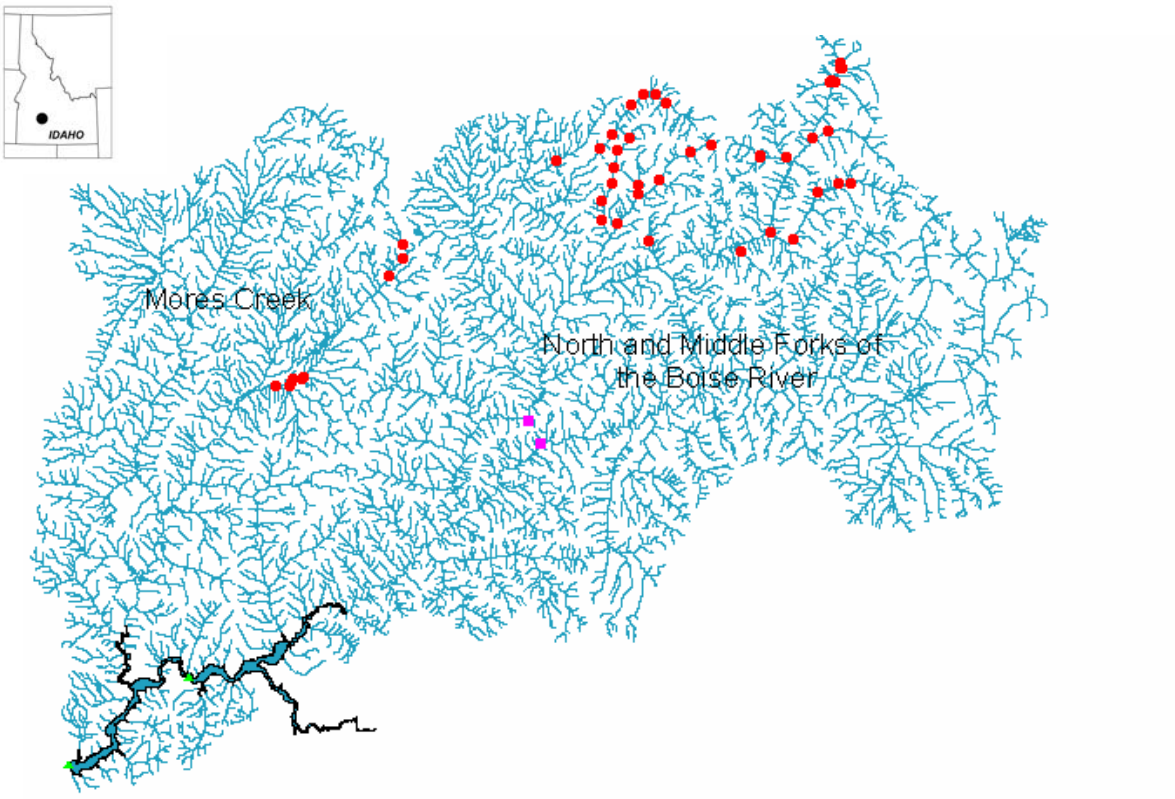

Figure 1. North and Middle Forks of the Boise River and Mores Creek watersheds with Arrowrock and Lucky Peak reservoirs. Arrowrock and Lucky Peak Dams (▲), North and Middle Fork Boise River weir traps(◆), and electrofishing sites(●) are noted.

This report is formatted in four chapters: a general introduction and study area chapter and three chapters that provide data corresponding to different sampling methods and sampling sites. Chapter Two provides data from the trap and transport project that was initiated in year 2000 and continued each spring season in Lucky Peak Reservoir. Chapters Three and Four summarize the population size and distribution monitoring work conducted under cooperative agreement between Boise National Forest and Reclamation.

Chapter Two

TRAP AND TRANSPORT OF BULL TROUT (*Salvelinus confluentus*) FROM LUCKY PEAK RESERVOIR TO ARROWROCK RESERVOIR, IDAHO

Abstract

Bull trout (*Salvelinus confluentus)* were captured in Lucky Peak Reservoir using weighted monofilament gill nets and transported above Arrowrock Dam for release into Arrowrock Reservoir. Trapping occurred between the months of April through May. A total of five bull trout were captured ranging from 419 mm to 494 mm in total length and 482 g to 1114 g in weight. Bull trout that were captured and released into Arrowrock reservoir were documented to migrate into main-stem rivers during the summer and fall months and one was recaptured during fall weir trap operations.

Study Area

The majority of the work discussed in this report occurred in Lucky Peak Reservoir on the mainstem Boise River (Figure 2). Lucky Peak Reservoir primarily stores water from the mainstem Boise River and from one small watershed, Mores Creek.

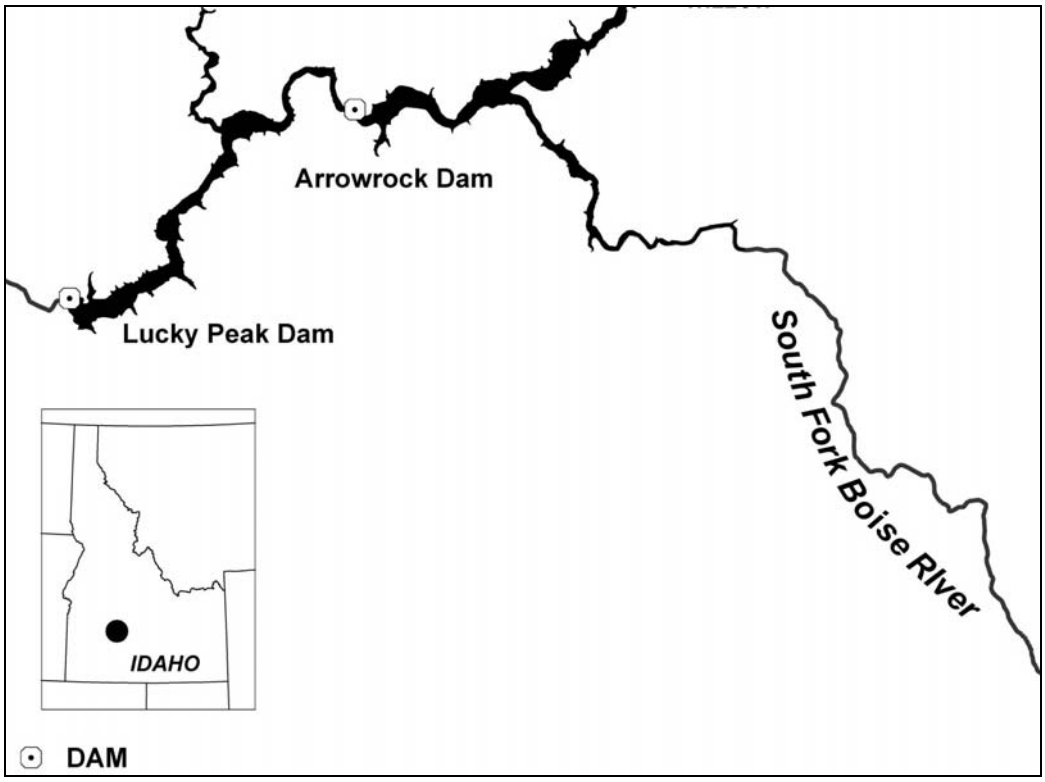

Figure 2. Lucky Peak and Arrowrock Reservoirs on the Boise River in Southwestern Idaho.

Methods

Fish were collected using sinking monofilament gillnets from April through late May. Experimental mesh, monofilament gillnets were also used to capture bull trout (Figure 2). Gillnets were set for 20 minute intervals during the daylight period from 8:00 to 18:00 hours four days per week. Nets were 30.5 m long x 1.25 m deep with four equal-length panels. Each panel had one of four mesh sizes: 3.18 cm, 5.04 cm, 6.35 cm, and 7.62 cm. The nets had lead core bottom lines that followed the bottom of the reservoir and foam core top lines to maintain the vertical orientation in the water. Each net had 8 kg weights to anchor the bottom line and 20 cm diameter buoys on the top line for marking location and retrieval. Catch rates for each species were calculated for hours that the nets were fished.

All captured bull trout were held in a 227 L live well of the boat with periodic water exchange until the end of each sampling day. The fish were then transported to Arrowrock reservoir, measured, tagged with PIT tags, and released. The seasonal period of trapping was chosen to increase efficiency of capture as bull trout were anticipated to be staging below Arrowrock dam in preparation for the upstream spawning migration each spring (Flatter 2000).

All fish captured were identified to species and enumerated. Total length (TL) was recorded for all game species. Bull trout were anesthetized using diluted tricaine methanesulfonate (MS-222) (approximately 100 mg/L). When a bull trout was considered anesthetized (could not right itself) it was measured and weighed. Scale samples and fin clips were taken, and the fish was scanned for Passive Integrated Transponder (PIT) tags (AVID computer corporation, Norco, CA 1999). All bull trout captured that were > 100 mm were tagged with 2.5 mm x 14 mm, 125 kHz PIT tags in accordance with instruction from Idaho Department of Fish and Game personnel (Russ Kiefer, IDFG, pers. comm.). Bull trout were held and monitored in live wells until full recovery (minimum 15 minutes), and then released into Arrowrock Reservoir. If surface water temperatures in Arrowrock Reservoir exceeded 18 C (65 F), bull trout were driven by boat to the areas of cooler water near river transition zones in the reservoir. Visible infirmity or injuries such as descaling, frayed fins, or dermal lacerations were noted for all bull trout captured.

Results

A total of 575 fish, representing ten species, were captured (Table 1). Gillnetting was used as the primary method of capture based on previous work in the Boise River system (Flatter 2000). Five bull trout were captured, which represented 0.01 percent of the total fish captured. They were not, however, the least abundant species sampled. Smaller numbers of fish species captured included kokanee (*O. nerka kennerlyi)*, and cutthroat trout *(O. clarki lewisi)*. The most abundant fish captured was the largescale sucker (*C. macrocheilus*), comprising 50 percent of all fish captured. Also noteworthy were hatchery rainbow trout (*Oncorhynchus mykiss)*, comprising 30 percent of the total fish captured.

Table 1. Catch data listed for gill net captures for all species

Species	CPUE (mean)	2.38
	Total Fish	575
	Total Hours	241.58
	Number Caught	*CPUE*
Bull trout (*Salvelinus confluentus*)	5	0.02
Cutthroat trout (*Oncorhynchus clarki lewisi*)	4	0.02
Largescale sucker (*Catostomus macrocheilus*)	288	1.19
Rainbow trout (*Oncorhynchus mykiss*)	164	0.68
Northern Pikeminnow (*Ptychocheilus oregonensis*)	14	0.05
Mountain whitefish (*Prosopium williamsoni*)	58	0.24
Chiselmouth (*Acrocheilus alutaceus*)	1	0.00
Bridgelip sucker (*Catostomus columbianus*)	19	0.08
Smallmouth bass (*Micropterus dolomieu*i)	22	0.09
Kokanee (*Oncorhynchus nerka kennerlyi*)	0	0.00

A total of five bull trout were captured ranging from 419 mm to 494 mm in total length and 482 g to 1114 g in weight. One bull trout was recaptured at the North Fork Boise River weir trap during the fall operation in 2005.

Discussion

Catch per unit effort for bull trout was lower than in previous years (0. 02) which may reflect lower numbers of fish and lower rates of entrainment. Data for all years will be compiled and summarized prior to March, 2006.

Chapter Three

DISTRIBUTION OF BULL TROUT (*Salvelinus confluentus)* IN THE NORTH FORK BOISE RIVER BASIN AND MORES CREEK, IDAHO

Abstract

Boise National Forest and USBR survey team collected 2955 individual fish representing 10 species in the 2005 Boise River surveys. One hundred sixty one bull trout were captured, and tagged with 125 kHz PIT tags. Habitat surveys were conducted on each of the 49 stream sites sampled. One site sampled where bull trout had previously been found had no fish; three other sites had fish but no bull trout. Bull trout were found in twenty-one of the forty-seven sites sampled that did have fish. Habitat degradation and increases in invasive species abundance may have caused the extirpation and reduction of populations of bull trout in the sites surveyed. Fisheries and habitat data will be entered into the Boise National Forest fisheries data base used for stream assessments.

Introduction

In response to the federal listing of bull trout, the U.S. Forest Service (USFS) and the U.S. Bureau of Reclamation (USBR) initiated a long term cooperative program to investigate the factors affecting their distribution in the Boise River basin. The work began in July 1999 and has continued. The purpose of the work was to assess habitat, water temperature, and flow conditions as they relate to bull trout distribution, abundance, and movement on a large-watershed scale. Southern Idaho has suffered multiple years of drought since 2000, with the most severe water shortage occurring in 2001. The long term monitoring of the North Fork Boise River habitats have allowed some insight into the impact of drought on fish density and distribution within this system. The objectives of this program are:

1. Monitor density and distribution of bull trout through time.
2. Determine the status of the bull trout populations in the North Fork Boise River following multiple years of drought.

Study Area

The work discussed in this report occurred in the North Fork Boise River that joins the Middle Fork Boise River 30 km upstream from the confluence of the South Fork and Middle Forks of the Boise River (Figure 1). The North Fork Boise River extends to 2,542 m elevation. The Boise River system is fed primarily by snowmelt run-off with highest flows occurring May-June and lowest flows in September-October.

Methods

Fish Data Collection

Stream reaches were sampled by electrofishing using multiple pass depletion methods. Density estimates were calculated from the depletions and a moidified R1/R4 protocol was used to collect habitat data at each stream site. In areas where riparian canopy or debris made stream access difficult single pass or select habitat units were sampled where access was possible. Smith-Root™ battery-operated electrofishers were used; batteries were changed every 3,500 to 4,000 operating seconds. Electrofishers were set between 500 and 900 volts and 30 to 40 Hz, depending on stream size and conductivity. Conductivity of Boise River streams range from 30 to 70 uS and stream temperature during survey work ranged from 9 to 18 $^{\circ}$ C.

All captured fish were identified to species and enumerated. Total length (TL) was recorded for all species. All amphibians were counted and released; though stage of development was not noted. Scale samples and fin clips were taken from all bull trout captured to be used for aging and genetic analysis. Bull trout were anesthetized using diluted tricaine methanesulfonate (MS-222) (approximately 100 mg/L). When a bull trout was considered anesthetized (could not right itself) it was measured and weighed. Scale samples and fin clips were taken, and the fish was scanned for Passive Integrated Transponder (PIT) tags (AVID computer corporation, Norco, CA 1999). All bull trout captured that were > 100 mm were tagged with 2.5 mm x 14 mm, 125 kHz PIT tags in accordance with instruction from Idaho Department of Fish and Game personnel (Russ Kiefer, IDFG, pers. comm.). Bull trout were held and monitored in live wells until full recovery (minimum 15 minutes), and then released into Arrowrock Reservoir.

Habitat Data Collection

Habitat condition was measured following modified R1/R4 methods of the USFS as described in Burton (1999). Each stream site was located with a Garmin™ GPS 76, and UTM coordinates were recorded in NAD 83. Habitat was measured using the following methodology: waters were first categorized by the observer as slow or fast based on USFS training (Burton 1999) and different measurements are taken for either slow or fast water. A two-meter stadia rod marked in tenth meter units was used to measure all habitat variables. Field staff was trained for habitat measurement under guidance of the USFS.

Parameters collected for slow water habitats were: thalweg lengths, maximum depth, mean depth, crest depth, averaged wetted width, available cover area, and percent fines in pool tails. Parameters collected for fast water habitats were: thalweg length, mean depth wetted width and available cover area.

Definition of Habitat Parameters Collected

Thalweg Length: thalweg length was the measured distance in the path of a stream that followed the deepest part of the channel from the crest of the slow water unit to the formative feature of the habitat unit (Armantrout 1998).

Crest depth: crest depth is the downstream point of transition of slow water habitat types. It is the shallow downstream end of the depression in scour pools and the point of greatest flow over a dam.

Maximum Depth: maximum depth was the greatest depth measured in the slow water type.

Mean Depth: mean depth was taken at the area where average width was measured.

*Depths were measured at approximately ¼, ½, and ¾ of the channel width and the average was calculated by dividing the sum by four (to account for zero depth at the banks).

Average Width: average width was the wetted width measured at location of the pool that was the mean depth calculated from the depth at the crest and maximum depth of the pool.

Available Cover Area: cover was categorized as large wood debris, undercut banks. All cover types had to be at least 0.30 m in width to be measured and capable of providing refuge to fish.

Grid Fines: percent fines were estimated at each slow water pool tail. Fines were measured using a 100-intersection grid. Field staff measured the percent of the wetted substrate area of pool tail that is made up of fine particles, defined as sand/silt less that 6 mm, by randomly tossing the grid. The cross section of the pool tail was subdivided into 3 segments: right, middle, and left. The grid intersections were counted only where substrate was smaller than 6 mm.

Elevation: UTM coordinates collected with a Garmin GPS 76 unit at each site. Waypoint locations were mapped and elevation (m) was taken from coordinates.

Results

A total of 49 sites were sampled in the North Fork Boise River basin and Mores Creek in 2005. Forty-two sites had multiple-pass depletion estimates calculated for salmonids and habitat data collected. Twelve species of fish were captured. There were 2955 individual fish captured including 184 bull trout ranging from 45 mm to 460 mm total length (Table 2). Three hundred nineteen tailed frogs of various life stages were also captured.

Table 2. Total fish captured during 2005 electrofishing sampling.

Species	Number caught
Bull trout *(Salvelinus confluentus)* (BT)	184
Cutthroat trout (CT) *(Oncorhynchus clarki lewisi)*	20
Mountain sucker (MTS) (*Catostomus platyrhynchus)*	147
Rainbow trout (RB) *(Oncorhynchus mykiss)*	712
Brook Trout (BR) (*Salvelinus fontinalis)*	62
Pike minnow (NPW) *(Ptychocheilus oregonensis)*	42
Mountain whitefish (MWF) *(Prosopium williamsoni)*	6
Sculpin spp. (SC) *(Cottus spp.)*	1397
Long Nose Dace (LND) *Rhynichthys cataractae*	235
Speckled dace *(Rhynichthys osculus)*	14
Red Sided Shiner (RSS) *Richardsonius balteatus hydrophlox*	150
Total Fish	**2955**

Bull trout were found in 21 of the 49 sites sampled. Rainbow trout were present in 41 of the 49 sites. Neither fish nor amphibian species were found in two sites on Bear River. Bull trout were present in high densities in one of these sites during surveys conducted in 2002. One bull trout (309 mm TL) was found above these sites in 2005.

Depletion estimates were calculated for sites sampled where bull trout were captured using Microfish 3.0 population parameter calculation software (www.MicroFish.org 2005)(Table 3).

Table 3. Population estimates from multiple pass depletions conducted in the Boise River drainage in 2005.

Site ID	Number captured						
	Pass 1	Pass 2	Pass 3	Pass 4	Pass 5	Estimate	Confidence range (% of estimate)
Ballentyne 0.5	2	5	2	0		9	33%
Ballentyne 2	14	11	2	0		27	7%
Bear Cr.54	1	1	1	0		3	100%
Bear Cr 48	1	0				1	0%
Bear R. 5	1	0				1	0%
Bear R. 10	1	0				1	0%
Big Silver 2	2	0				2	0%
Crooked R 159	1	0	1	0		2	350%
Crooked R 19	0	0	2	0	2	6	0%
Crooked R 20	3	3	1	0		7	14%
Crooked R 22	19	2				21	5%
Crooked R 24	12	8	1	0		21	5%
Johnson 01	1	2	1	0		4	75%
Johnson 03	1	0				1	0%
Johnson 05	7	3				10	30%
McLeod 0	20	7				29	21%
McPhearson 0	3	0				3	0%
North Fork 39	10	6				20	70%
North Fork 40	1	0				1	0%
North Fork 405	6	0				6	0%
West Fork 0	9	5	2			17	24%

Table 4 shows the sites sampled and number of each species captured in each site.

Table 4. Fish capture for 49 sites sampled with multiple-pass depletion methods in 2005.

Creek name	Species and number captured											
	BT	RB	SC	CT	BK	RSS	LND	WF	MTS	SD	PM	AMPH
Ballentyne 0.5	9	17	11	0	0	0	0	0	0	0	0	29
Ballentyne 2	28	8	1	0	0	0	0	0	0	0	0	0
Bear Cr. 34	0	18	0	0	0	0	0	0	0	0	0	0
Bear Cr. 54	3	4	2	0	0	0	0	0	0	0	0	0
Bear Cr. 1	0	9	29	0	7	0	0	0	0	0	0	0
Bear Cr. 2	0	15	4	0	14	0	0	0	0	0	0	0
Bear Cr. 4	0	12	0	2	0	0	0	0	0	0	0	0
Bear Cr. 48	1	10	0	0	0	0	0	0	0	0	0	0
Bear River 5	1	14	92	0	5	0	0	0	0	0	0	0
Bear River 10	1	12	0	0	0	0	0	0	0	0	0	0
Bear River 12	0	0	0	0	0	0	0	0	0	0	0	0
Bear River 8	0	14	54	0	1	0	0	0	0	0	0	0
Bear River 98	0	0	0	0	0	0	0	0	0	0	0	0
Big Silver 2	2	15	0	0	0	0	0	0	0	0	0	10
Cow Cr 1	0	38	49	0	0	0	0	0	0	0	0	11
Crooked R. 159	2	5	36	0	12	0	0	0	0	0	0	0
Crooked R. 17	0	4	33	0	1	0	0	0	0	0	0	10
Crooked R. 19	4	16	109	0	5	0	0	0	0	0	0	4
Crooked R. 20	7	0	32	0	0	0	0	0	0	0	0	0
Crooked R. 22	21	0	0	0	0	0	0	0	0	0	0	0
Crooked R. 24	21	0	0	0	1	0	0	0	0	0	0	0
Cub Cr. 0	0	29	0	0	0	0	0	0	0	0	0	0
Hunter Cr. 1	0	34	0	0	0	0	0	0	0	0	0	0
Johnson 1	4	30	90	0	0	0	0	0	0	0	0	44
Johnson 03	1	71	26	0	0	0	0	0	0	0	0	0
Johnson 05	10	37	51	0	0	0	0	0	0	0	0	1
Johnson 06	0	9	61	0	0	0	0	0	0	0	0	0
Johnson 07	0	6	138	0	0	0	0	0	0	0	0	0
Little Silver 0	0	30	0	0	0	0	0	0	0	0	0	13
Lodgepole 05	0	9	0	16	0	0	0	0	0	0	0	0
McLeod 0	27	1	0	0	0	0	0	0	0	0	0	17
McPhearson 0	3	6	0	0	0	0	0	0	0	0	0	23
Mores Cr HDW	0	2	0	0	0	0	0	0	0	0	0	0
Mores Cr HF	0	6	27	0	3	0	0	0	0	0	0	0
Mores Cr 21	0	45	0	0	2	0	0	0	0	0	0	6
Mores Cr IC1	0	15	0	0	0	0	95	0	19	2	0	0
Mores Cr IC2	0	0	23	0	0	14	121	0	54	1	0	0
Mores Cr IC3	0	13	0	1	0	125	34	0	99	3	40	0
Mores Cr IC4	0	8	40	0	0	12	91	0	12	5	2	0
Mores Cr IC5	0	3	59	0	0	0	33	0	0	0	0	0
Mores Cr IC6	0	8	93	0	0	0	10	1	1	1	0	0
Mores Cr IC7	0	0	201	0	0	0	21	0	0	2	0	0
North Fork 39	16	7	16	0	0	0	0	5	0	0	0	14
North Fork 40	1	20	10	0	0	0	0	0	0	0	0	19
North Fork 405	6	28	38	0	0	0	0	0	0	0	0	38
Pikes Fork 06	0	7	38	0	6	0	0	0	0	0	0	13
Rocky Cr. 1	0	25	21	0	0	0	0	0	0	0	0	0
Rocky Cr. 0	0	29	14	0	4	0	0	0	0	0	0	0
West Fork 0	16	1	23	0	0	0	0	0	0	0	0	68

Discussion

The Boise River Basin has undergone five years of drought in combination with severe fires, flooding, and the near complete drafting of Arrowrock reservoir during the winter of 2003. Review of preliminary data from 2005 shows that bull trout were not found in four sites where they had been found in previous years. All data from this year's North Fork Boise River monitoring sites will be summarized with habitat and watershed environmental data for the seven years of the project. Future surveys should continue to monitor fish presence and habitat conditions in areas affected by recent wildfires and drought. Areas where bull trout populations appear to have been extirpated should be priority sampling areas to confirm new information.

Chapter Four

INFERENCES FROM WEIR COUNTS OF POPULATION SIZE AND MIGRATION TIMING FOR ADFLUVIAL BULL TROUT (*Salvelinus confluentus)* IN THE NORTH AND MIDDLE FORKS OF THE BOISE RIVER, IDAHO

Abstract

Bull trout (*Salvelinus confluentus)* were captured using steel frame picket weir traps set across the North and Middle Forks of the Boise River in Southwestern Idaho. Trapping occurred between the months of August and October in the North Fork and Middle Fork Boise River. The combined fish capture was 201 fish representing seven genera and nine species (Table 1). A total of 62 bull trout (30.8 % of total fish captured) were captured and 42 were tagged with PIT tags.

Introduction

In compliance with the Endangered Species Act (ESA), the U. S. Fish and Wildlife Service (FWS) developed a recovery plan and proposed critical habitat designation which included guidelines for management agencies to facilitate bull trout recovery. Since bull trout have a rather extensive range in the Columbia River segment, teams were established by major watersheds or regions. The Boise Basin bull trout populations are located in the Southwest Basin recovery unit. The federal bull trout recovery team has outlined several important objectives for bull trout recovery. These were: 1) maintenance and restoration of the distribution of bull trout 2) maintenance and restoration of habitat for all life history forms 3) conservation of genetic diversity, and 4) implementation of recovery actions and assessment of their success (FWS 2002). Meeting the objectives of recovery require that accurate estimates of population size, assessment of distribution, and trends in abundance are known for bull trout populations within each recovery unit. In 1999, U.S. Bureau of Reclamation (Reclamation) and Boise National Forest (BNF) developed a cooperative program to begin gathering baseline data to be used to meet the recovery objectives and also follow ESA Section 7 consultation requirements. Work began in July 1999 and is ongoing. The purpose of the work is to assess temperature, precipitation, and stream discharge conditions as they relate to bull trout movement, population size, and survival on a large-watershed scale. Work to address the study objectives was initially focused on the North Fork Boise River basin which contains the largest population of adfluvial bull trout and most stream miles of spawning and rearing habitats. Weir work was expanded to include the Middle Fork Boise River in 2002, 2003 and 2005. Flooding and poor conditions in the Middle Fork Boise River precluded weir installation in 2004. The following objectives were addressed through weir trap operation:

1. To quantify population size and trends of migratory bull trout within the Boise River drainage
2. To quantify fish length at age and growth rates of bull trout within the Boise River watershed
3. To examine survival of bull trout and environmental conditions that may affect survival.

This report presents data collected from the fish counts using steel frame picket weir traps operated on the major migration corridors of the North Fork and Middle Forks of the Boise River during the fall 2005 season.

Study Area

This work occurred on the mainstems of the North and Middle Forks of the Boise River. Crews were stationed at Barber Flats Guard station and monitored stationary traps located adjacent to the guard station on the North Fork Boise River and on the Middle Fork Boise River at Alexander Flat (Figure 1).

Methods

Steel frame picket weirs were operated across the major migratory corridor in both the North and Middle Forks of the Boise River below most known spawning and rearing habitat for bull trout. A 39.50 m (130 ft.) long x 1.53 m (5 ft.) tall steel picket style weir with upstream and downstream traps was constructed across the full width of the North Fork Boise (rkm 22.7 or rm 12.25) and the Middle Fork Boise River (rkm 15.6 or rm 8.42). Both traps were operated adjacent to the U.S. Forest Service Barber Flat guard station from the end of August through October. The weirs were constructed of 15, 3.05 m (10 ft.) angle iron frames with steel conduit pickets spaced 1.25 cm (0.5 in.) apart. The traps were built following design recommendations and guidance from Russ Thurow (1999). Operating time was planned during the post spawning migration of bull trout. Time and duration of the post-spawning run coincides with periods of lowest river discharge (Reclamation 2004, Flatter 2000). The trap acted as a migration barrier for all fish > 1.25 cm (0.5 in.) in width (approximately > 200 mm or 7.9 in. total length for bull trout), capturing fish in traps as they moved upstream or downstream. Traps were checked, and pickets cleaned three times per day. Fish observed holding upstream of the weirs were netted at night using dip nets when possible.

All fish captured were identified to species and enumerated. Total length (TL) was recorded for all game species. Bull trout were anesthetized using tricaine methanesulfonate (MS-222) (80 mg/L dilution). When a fish was considered anesthetized (could not right itself) its total length and weight was recorded. A scale sample and fin clip were taken, and the fish was scanned for Passive Integrated Transponder (PIT) tags (AVID computer corporation, Norco, CA 1999). All bull trout > 100 mm TL which did not carry tags were tagged with 2.5 mm x 14 mm, 125 kHz PIT tags in accordance with instruction from Idaho Department of Fish and Game personnel. Bull trout were held and monitored in live wells until full recovery (minimum 15 minutes), and then returned to the vicinity of capture. If bull trout were captured in stationary traps, direction of migration and time of capture was noted. Fish capture was recorded by date and time of trap check. Groupings and pairs of fish were noted. All recaptured bull trout were measured and weighed so that data for growth over the time period from mark to recapture could be calculated.

Results

The combined fish capture was 201 fish representing seven genera and nine species (Table 5). A total of 62 bull trout (30.8 % of total fish captured) were captured and 42 were

tagged with PIT tags. The majority of fish captured were mountain whitefish (39.9 % of total), mostly in middle to late October during their spawning migration. Rainbow trout were the third most abundant species captured (13.8 % of total), but total capture was low in comparison to bull trout and whitefish. Most bull trout were captured during the night period from 21:00 to 06:00, and the majority of bull trout were captured moving downstream or netted from in front of the trap fence at night.

Table 5. Total number of fish captured from the Boise River weir traps in 2005.

Species	Middle Fork Weir Trap	North Fork Weir trap
Bull trout *(Salvelinus confluentus)*	3	59
Cutthroat trout (*Oncorhynchus clarki lewisi)*	4	1
Largescale sucker *(Catostomus machrocheilus)*	3	2
Rainbow trout *(Oncorhynchus mykiss)*	3	25
Pike minnow *(Ptychocheilus oregonensis)*	7	2
Mountain whitefish *(Prosopium williamsoni*)	10	71
Kokanee *(Oncorhyncus nerka kennerlyi)*	2	6
Long Nose Dace *Rhynichthys cataractae*	1	1
Red Sided Shiner *Richardsonius balteatus hydrophlox*	1	0
Total Fish	**34**	**167**

A total of 45 of the 62 bull trout were PIT tagged at the weir traps. Seventeen bull trout were recaptures from previous years of trap operations or other work within the Boise River basin. Of the 62 bull trout captured, 21 were juvenile sized bull trout (<300 mm TL) and were not used in the population estimates. The ratio of juvenile sized to adult sized bull trout captured in 2005 was 0.55, or 36 percent of the total bull trout captured.

The annual mark-recapture population estimate for adult bull trout (> 300 mm TL) from the North Fork weir trap was 39 bull trout (s = 5.41). An estimate was not calculated for the Middle Fork weir trap due to the fact that no fish were recaptured and the trap was not operated in 2004.

Discussion

Very low numbers of bull trout were captured the North and Middle Fork Boise River weir traps in comparison to previous years. Several factors may explain the low numbers. First, the Boise River basin has experienced five years of low winter snow pack and corresponding

drought conditions. In 2005, record precipitation was received as rain in May and June, but this occurs after alevin emergence and egg incubation for bull trout. Low stream flows may impact rearing juveniles and incubating eggs by increasing formation of anchor and frazile ice, limiting invertebrate production, and causing fish to emigrate (Annear 1987). Second, the Arrowrock Reservoir construction project and corresponding reservoir drawdown incurred significant numbers of mortalities for bull trout as documented in Salow and Hostettler (2004). These combined factors will probably contribute to low numbers of adfluvial bull trout in the Boise Basin for several generations. Data from the seven years of trap operations will be summarized and distributed by March 2006.

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